

(21) Application No. 47959/76 (22) Filed 21 May 1976

(44) Complete Specification Published 7 Nov 1979

(51) INT. CL.² A61B 5/05
H05K 3/12 // 1/02(52) Index at Acceptance
H1R 2A1A 2B 2J3 2JX
A5K 6

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(19)

(54) AN ENURESIS DETECTOR PAD HAVING A
PRINTED ELECTRIC CIRCUIT ELEMENT

(71) We, MEDTRON ELECTRONICS PTY. LTD, of 1002 Nepean Highway, Mornington, in the State of Victoria, Commonwealth of Australia and a company incorporated under the laws of the State of Victoria, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to an enuresis detector pad having an electric circuit defined by an electrically conductive coating and in a particular to a urine sensitive switching element for use in an enuresis monitor.

Enuresis monitors conventionally include a urine sensitive detector pad which is placed immediately under the lower bed sheet of a patient. A known pad for this purpose includes a pair of aluminium foils, one perforated, the other not, which sandwich a core of highly absorbent electrically insulating paper. A urine deposit of sufficient volume permeates the paper to bridge an open circuit provided by the foils and thereby switches an alarm device. In another known arrangement, the pad comprises two sets of metal strips adhered, to the upper surface of a plastics sheet and the urine deposit spreads over the surface of the sheet. Generally, the pad is arranged to respond to initial traces of urine absorbed through the bedsheet to trigger an audible alarm and so waken the patient.

Devices of the above type are invaluable in the training of older incontinent children and in geriatric monitoring applications, but have to date suffered from the disadvantage that the urine sensitive pad is expensive and difficult or even quite impracticable to clean and maintain in an acceptably sanitary odour-free condition for any length of time. Apart from this, many older and younger people are disturbed by the knowledge that

they are sleeping on an object having the appearance of cold metal or electronic gadgetry.

According to the invention, there is provided an enuresis detector pad of electrically insulating material on which an electrically conductive coating is printed, wherein the said electrically conductive coating has two portions one of which comprises a multiplicity of line segments defining an identifiable pattern or shape and the other of which comprises a continuous line following the shape of the first conductive portion, the two portions being spaced and electrically isolated from one another to define an open electric circuit which is closed when the space between the two portions is bridged by urine.

For rendering the circuit sensitive to contact with urine, the pad may be formed of a material which is capable of distributing urine so that it electrically bridges the separated portions of the coating. These portions are provided on a common face of the pad, which face is rendered substantially impervious to liquid whereby urine might distribute as aforesaid by spreading over said face.

The coating may comprise a conductive ink composition applied to the pad in a screen printing process and may accordingly consist of a multiplicity of line segments, including curved line segments, defining an identifiable pattern of shape. For example, where it is desired to use the pad as the urine sensitive switching element of an enuresis monitor, this shape may advantageously be that of an animal such as a friendly kangaroo, dog or koala in order to lessen the patient's concern at the presence of the element.

The ink is suitably a carbon-based latex ink such as, for example, a mixture of a first composition comprises graphite in solution and a second composition comprising a latex

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ink or paint. The exact proportions of the two compositions may vary widely and the most satisfactory mixture must be determined empirically for any particular design or construction of electric circuit element in accordance with the invention.

The invention also contemplates an enuresis monitor comprising a pad in accordance of the invention and electric circuit means including an indicating device which circuit means is so coupled to the circuit element as to be responsive to bridging of the separated portions of the coating by urine to actuate the indicating device. In use, the pad is laid immediately under the sheet of a patient's bed. In this disposition, an initial trace of urine deposited by the sleeping patient and passed through the sheet will be received and distributed by the pad, which would of course be strategically placed to receive the urine, and thereby electrically bridge the separated portions of the coating. If the resistivity is reduced by an adequate predetermined factor, an electric potential will appear which is of sufficient magnitude to trigger the indicating device, either directly or through a transistor and/or relay circuit, and so alert the sleeping individual to the state of his bladder.

It will be readily apparent that the application of the circuit element in accordance with the invention is not limited to its use as an electrolyte sensitive switch. The pad might be of paper, cardboard or plastics material and the coating might be of a configuration suitable for playing a game, either with elements such as tokens capable of electrically bridging separated parts of the coating or with external probes associated with circuitry for indicating or scoring in dependence upon the portion of the coating touched by the probe.

The invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a plan view of an enuresis detector pad in accordance with the invention;

Figure 2 is schematic diagram of an enuresis monitor incorporating the element of *Figure 1*; and

Figure 3 is an electric circuit diagram pertaining to the monitor of *Figure 2*.

The illustrated circuit element includes a 50 × 75cm electrically insulating pad 10 of thin but strong paper of a conventional variety. The body of pad 10 readily absorbs liquid but one of its faces 10a, is treated so as to render it substantially impervious to the passage of liquid. Respective separated portions 12, 13, 14, of an electrically conductive ink are applied as a coating to face 10a in a screen printing process. Portions 12, 14 are mutually electrically isolated by pad

10 but each is in itself electrically contiguous. Portion 12 consists of a multiplicity of connected curved line segments defining an outline, and some of the features, of an identifiable pattern or shape, namely a dancing beaver, which is indicated generally at 11. Portion 13, on the other hand, comprises a single line closely enclosing the shape defined by portion 12. Portion 14 constitutes the facial features of the beaver 11. Included as a respective part of coating portions 12, 13 are tabs 16, 18 which terminate at an edge of the pad at adjacent but discrete locations 16a, 18a.

The electrically conductive ink employed is a mixture of a first composition comprising graphite in solution and a second composition comprising a latex based ink or paint.

The element depicted in *Figure 1* is well-suited to use as the urine sensitive switching element of an enuresis monitor. The cost of producing it by screen printing techniques, is low thus making it feasible to treat the pad as a disposable component after first soiling. Principal components of an enuresis monitor incorporating the pad are shown schematically in *Figure 2*. Pad 10 is placed immediately under the bottom sheet 30 of a bed 28 and tabs 16, 18 electrically coupled by way of clips such as bulldog clips 32 and leads 34 to an indicator box 36. Circuitry in the box is arranged to be sensitive to bridging of coating portions 12, 13 to activate a visible or audible alarm as required. Box 36 may be located beside the bed for the purpose of waking the patient or may be disposed at a monitoring station remote from the patient.

A circuit diagram of the arrangement is to be found in *Figure 3*. A constant voltage source 40 such as a battery includes a positive terminal 40a and a negative terminal 40b. Terminal 40a is connected to the collector 42a of a npn transistor 42 by way of a protector resistor 44, the emitter 42b being coupled by a capacitor 43 to terminal 40b. Pad 10 is also connected across terminals 40a, 40b in series with a potentiometer 46, the variable arm of which is wired to the base 42c of transistor 42. A second capacitor 45 bridges base 42c to terminal 40b.

Also connected in series across terminals 40a, 40b are a series wired alarm 47 and silicon controlled rectifier 48. When urine bridges coating portions 12, 13, a potential is applied at base 42c to set transistor 42 ON. SCR 48 is triggered and alarm 47 set off. The alarm remains on even when the input to the SCR is removed until a switch 49 is cycled to reset the circuit.

It will be appreciated that the above described and illustrated enuresis monitor is in several respects more acceptable for its intended purpose than known monitors.

Most importantly, the urine sensitive pad, having been mass produced in a screen printing process, has a relatively very much smaller production cost than known pads incorporating metal parts and can be readily considered as a disposable component after soiling. Thus, once the pad has been soiled by urine, it can be immediately disposed of and substituted by a fresh, clean pad. With the urine sensitive pads of known monitors, it is of course not economically feasible to do this and cleaning of the pad is necessitated.

A further consequence of the printing of the coating portions onto the pad is that the coating can be designed as a set of connected or adjacent line segments, preferably including curved segments, defining a recognizable figure and being quite lacking in the clinical and coldly mechanical or metallic appearance typical of pads previously employed.

WHAT WE CLAIM IS

1. An enuresis detector pad of electrically insulating material on which an electrically conductive coating is printed, wherein the said electrically conductive coating has two portions one of which comprises a multiplicity of line segments defining an identifiable pattern or shape and the other of which comprises a continuous line following the shape of the first conductive portion, the two portions being spaced and electrically isolated from one another to define an open electric circuit which is closed when

the space between the two portions is bridged by urine.

2. A pad according to claim 1, wherein the coatings are provided on a common face of the pad, which face is rendered substantially impervious to liquid whereby urine received onto said face may distribute by spreading on the face so as to electrically bridge the two portions of the coating.

3. A pad according to any preceding claim wherein the coatings are applied by way of a screen printing process.

4. A pad according to any one of the preceding claims wherein the multiplicity of line segments defining an identifiable animal shape.

5. A pad according to any one of the preceding claims wherein the coating includes an ink incorporating a mixture of a first composition comprising graphite in solution and a second composition comprising a latex-based ink or paint.

6. A enuresis monitor comprising a pad in accordance with any one of the preceding claims and electric circuit means including an indicating device which circuit means is so coupled to the circuit element as to be responsive to bridging of the separated portions of the coating by urine to actuate the indicating device.

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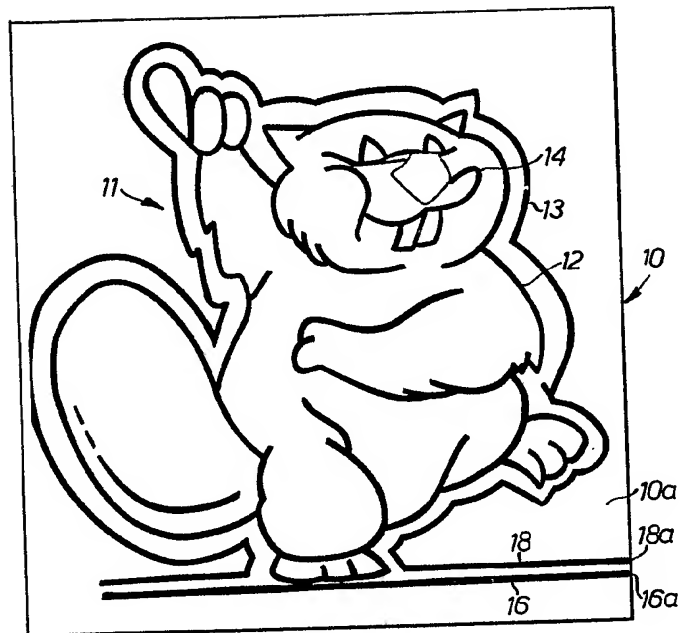


FIG. 1.

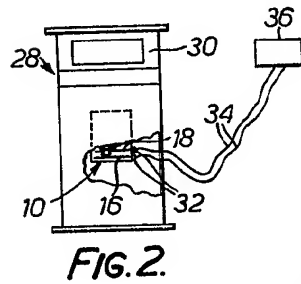


FIG. 2.

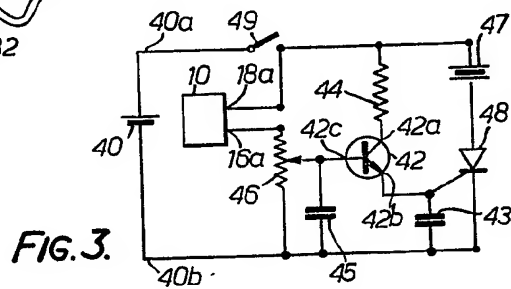


FIG. 3.